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ABSTRACT

Educators and museum evaluators are attempting to understand the influence science museums have upon science education and the kinds of learning experiences visitors have in the multisensory, informal learning environments of science museums. The problem investigated in this study involved the effectiveness of the exhibit interpreter. The study took place at two science museums. In each setting, visitors were observed in situations in which the interpreter was present and when the interpreter was absent once on a weekday and once on a weekend. Visitor behavior was filmed unobtrusively for analysis. It was found that interpreters significantly influenced the amount of time spent in an exhibit and the attending behaviors of those visitors on weekends and weekdays; age was not a consistent influence on the interaction between interpreter and visitors. (CW)

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The Exhibit Interpreter: An Attention-Focuser In Science Museums

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Abstract

Educators and museum evaluators are attempting to understand the influence science museums have upon science education and the kinds of learning experiences visitors have in the multisensory, informal learning environments of science museums. Some research has centered around the amount of visitor attention which is focused upon museum exhibits and hands-on experiences available. However, very little study has been given to the exhibit interpreter as an attention-focuser in the complementary role of interfacing between the exhibit and the visitors. In this role the interpreter assists visitors in attending to the exhibits by explaining or showing how exhibits operate, by pointing out scientific principles illustrated by exhibits, or by complementing exhibit information in other ways. The problem as pursued in this research was to answer the question, "Is the exhibit interpreter in the complementary role of interfacing between the visitors and the exhibits an effective attention-focuser in a science museum?"

The study was conducted in the spring of 1988 in two science museums: the Science Museum of Virginia in Richmond, Virginia, and Discovery Place in Charlotte, North Carolina. Two observational periods were conducted at each museum, one on a weekday and one on a weekend day. Visitor behavior at each exhibit area was filmed unobtrusively by a stationary camera. Subjects for the study were the first 50 visitors to enter the exhibit area when an interpreter was present and when an interpreter was not present. The exhibit areas contained hands-

on, interactive exhibits and received both destination and flow-through traffic. The data necessary for assessing the interpreter's effectiveness as an attention-focuser was gathered during review of the videotapes of these observations. The length of time visitors spent at the exhibit area, visitor age, and visitor attending behaviors were recorded. Statistics used to analyze the data included a z-test for proportionally, a chi-square, and analysis of variance.

The findings and conclusions of this study were: 1) The presence of the exhibit interpreter significantly influenced the increase in time spent and in the number of attending behaviors demonstrated in the exhibit area on weekdays at each museum. 2) At both museums on weekend days there was a trend toward increased time spent and the number of attending behaviors demonstrated in the exhibit area while the interpreter was present. 3) Age and the interaction of age and the interpreter presence were not consistent influences on time spent or number of attending behaviors demonstrated in either museum. However, it was observed that adults spent a longer time in the exhibit area in the Science Museum of Virginia and teens and children spent more time in the exhibit area at Discovery Place.

The exhibit interpreter possesses many of the attributes researchers have identified as successful attention-focusing devices: positive feedback, movement, potential for interaction, sound, guidance, complexity and familiarity. The findings of this study will assist science museum educators in making decisions about the effective use of exhibit interpreters.

THE EXHIBIT INTERPRETER: AN ATTENTION-FOCUSER IN SCIENCE MUSEUMS

Introduction

Science museums, the popular new pacesetters of the museum field, are having an increasing influence on science education. Educators and evaluators are attempting to understand the nature of this influence and the kinds of learning experiences museum visitors have in the multisensory, exciting informal learning environments of science museums. At the International Congress on Learning in Museums one of the two major goals of the Congress was "to develop a better understanding of the museum as a learning environment for the casual observer" (Tymitz-Wolf 1986). John Falk in his summary for the NSTA committee on Excellence in Science in Non-School Settings applauds the efforts of many informal science settings, but points out that "greater efforts must be undertaken to determine the effectiveness of informal education" (Falk 1985). What a visitor learns in a museum is not a narrow spectrum of information by intention of museum educators nor actual outcomes of visitor learning. Museums are reverential places, social spaces, as well as educational places. Not all exhibits or elements in the museum are intended to teach or deliver specific content, but may serve to stimulate interest, exploratory behaviors, aesthetic appreciation, or amusement and relaxation. However, many exhibits are designed to deliver specific content and museologists want to know what and if the casual visitors learn from these exhibits.

Studies of museum visitors and visitor behavior indicate that one reason visitors come to museums is to learn, and that

visitors can and do learn from exhibits (The Commission on Museums for a New Century 1984; Wolf, Munley, & Tymitz 1979; Shettel 1973). Some research has centered around the amount of visitor attention focused on the exhibits and hands-on experiences available in museums (Shettel 1973; Their & Linn 1975; Wolf 1980; Koran, Lehman, Shafer, & Koran 1983; Koran, Morrison, Lehman, Koran, & Gandora 1984; Peart 1984; Koran, Koran, & Longino 1986; Screven 1986; Koran, Koran, Foster, & Dierking 1986; Beer 1987). Gagne in his information-processing model of learning and memory views attention-focusing as the first step to learning (Gagne 1977). In order to understand how, what, and why a visitor learns in a science museum, it is necessary to understand what influences attention in the novel, stimulus-rich environment of science museums. What aids (labels, buzzers, manipulative, or interpreters) are helpful in assisting the visitor to selectively attend to aspects of the science museum's learning environment, a multisensory collage of scientific, aesthetic, spacial, and social information? Characteristics of exhibits such as, the interactiveness and physical features have been examined for their attention holding power, but very little research has been conducted on the attention-focusing power of the exhibit interpreter. Recommendations for study of the exhibit interpreter's influence in science museums have been suggested by recent research (Koran, Koran, Foster, & Dierking 1986; Tymitz-Wolf, 1986b).

Objectives

The purpose of this study was to determine whether the

exhibit interpreter in the complementary role of interfacing between the exhibits and visitors is effective in attracting and focusing the attention of the casual visitor in a science museum. In this role the interpreter--volunteer, museum educator, or student explainer--assists visitors in attending to exhibits by explaining or showing how exhibits operate, by pointing out scientific principles illustrated by the exhibits, or by complementing exhibit information in other ways. In examining this interface role of the interpreter, one essential aspect to consider is whether the interpreter <u>is</u> an effective attention-focuser as measured by length of time visitors spend at the exhibits and the number of attending behaviors demonstrated while the interpreter is present in the exhibit area.

Problem

Specifically, this study addressed two main questions:

(1) Does the presence of an interpreter at a science museum exhibit area affect the length of time spent at an exhibit area?

(2) Does the presence of an interpreter at a science museum exhibit area affect the number of attending behaviors demonstrated at an exhibit area?

In addition, this study examined six related questions:

(1a) Does the age of the visitor attending a science museum exhibit area affect the length of time spent at an exhibit area?

(1b) Do the factors of the age of the visitor and presence of an interpreter at a science museum exhibit area, interact to affect the length of time spent at an

exhibit area?

(2a) Does the age of the visitor attending a science museum exhibit area affect the number of attending behaviors demonstrated at an exhibit area?

(2b) Do the factors of age of the visitor and presence of an interpreter at a science museum exhibit area interact to affect the number of attending behaviors demonstrated at an exhibit area?

(3) Does the presence of an interpreter at a science museum exhibit area affect the age of the visitor attracted to an exhibit area?

(4) Does the presence of an interpreter at a science museum exhibit area affect the number of visitors attracted to an exhibit area?

General Procedures and Design

This research was conducted in the spring of 1988 in two science museums, the Science Museum of Virginia in Richmond, Virginia, and Discovery Place in Charlotte, North Carolina. Prior to this study in the spring of 1987, a pilot study was conducted on a weekend day at the Science Museum of Virginia to access feasibility and observation techniques to be used.

In this study, two observations were made at each museum, one on a weekday and one on a weekend day. Visitor behavior at an exhibit area with the exhibit interpreter present and without the exhibit interpreter was filmed during each observation period. Subjects for the study were the first 50 visitors to enter the exhibit area when an interpreter was present and when

an interpreter was not present. A total of 100 subjects were filmed during three of the four filming sessions. On the fourth filming session, only 30 subjects entered the exhibit area during the filming of the exhibit area when the interpreter was not present. Therefore, in that part of the study the visitor behavior of 60 subjects was recorded.

In order to gather the data necessary for assessing the exhibit interpreter's effectiveness as an attention-attracter and attention-focuser the tapes were reviewed. The age and time spent by each visitor in the exhibit area was recorded for all four observation periods. The number and category of attending behaviors demonstrated in the exhibit area was recorded for all four observation periods. The number of visitors attracted into the exhibit area among the first fifty visitors passing by the area when the exhibit interpreter was present and then not present on the weekend day session at the Science Museum of Virginia was recorded.

The data gathered from the tape reviews was analyzed using the statistical techniques of a z-test for proportionality, a chi-square analysis, and the analysis of variance using SPSS-X programs on a Cyber 180/855 computer.

Findings

The findings of this study on the exhibit interpreter in the complementary role of interfacing between the exhibits and science museum visitors indicate that the exhibit interpreter was effective in focusing the attention of visitors in the exhibit area during weekday observations at both museums. This was

evidenced by the fact that visitors in the exhibit area when the interpreter was present spent significantly more time and demonstrated significantly more attending behaviors. In addition, during weekend observations at both museums, trends indicated that the exhibit interpreter positively influenced the length of time spent and the number of attending behaviors demonstrated in the exhibit area.

In the specific findings on the question, "Does the presence of an interpreter at a science museum exhibit area affect the length of time spent at an exhibit area?", the results of the statistical analysis of the data collected on a weekday at Discovery Place showed a mean of 248.84 seconds for time spent in the exhibit area when the interpreter was present and a mean of 151.82 seconds for time spent in the exhibit area when the interpreter was not present and produced a significant F-Ratio of 9.394 ($p < .01$).

NULL HYPOTHESIS: There is no relationship between the presence of an interpreter at a science museum exhibit area and the length of the time spent at an exhibit area.

The descriptive statistics for this case are summarized in Table 1 and the analysis of variance is summarized in Table 2.

Table 1

Summary of Descriptive Statistics
Relating Presence of Interpreter to Time Spent
in Exhibit Area on a Weekday at
Discovery Place

Mean Time Spent in Exhibit Area		Number of Subjects: 100		Standard Deviation
With Interpreter	Without Interpreter	With Interpreter	Without Interpreter	
248.84 seconds	151.82 seconds	50	50	166.79

Table 2

Results of the Analysis of Variance Relating
Presence of Interpreter to Time Spent in
Exhibit Area on a Weekday at
Discovery Place

Source of Variation	Sum of Squares	df	Mean Square	F-Ratio	Significance of F
Interpreter	239780.199	1	239870.199	9.394	.003
Residual	2450504.515	56	25526.089		

The results of the statistical analysis of the data collected on a weekday at the Science Museum of Virginia showed a mean of 95.00 seconds for the time spent in the exhibit area when the interpreter was present and a mean of 32.73 seconds for time

spent in the exhibit area when the interpreter was not present and produced a significant F-Ratio of 18.493 ($p < .001$). The descriptive statistics for this case are recorded in Table 3 and the analysis of variance is summarized in Table 4.

Table 3

Summary of Descriptive Statistics
Relating Presence of Interpreter to Time Spent in
Exhibit Area on a Weekday at
the Science Museum of Virginia

Mean Time Spent in Exhibit Area		Number of Subjects: 60		Standard Deviation
With Interpreter	Without Interpreter	With Interpreter	Without Interpreter	
95.00 sec	32.73 sec	30	30	79.708

Table 4

Results of the Analysis of Variance Relating
Presence of Interpreter to Time Spent in
Exhibit Area on a Weekday at the
Science Museum of Virginia

Source of Variation	Sum of Squares	df	Mean Square	F-Ratio	Significance of F
Interpreter	72834.970	1	72834.970	18.493	.000
Residual	220562.415	56	3938.615		

The results of the statistical analysis of the data collected for this question on a weekend day at Discovery Place and on a weekend day at the Science Museum of Virginia showed a trend toward visitors spending more time in the exhibit area when the interpreter was present.

In the specific findings on the question, "Does the presence of an interpreter at a science museum exhibit area affect the number of attending behaviors demonstrated at an exhibit area?", the results of the statistical analysis of the data collected on a weekday at Discovery Place showed a mean of 9.46 for number of attending behaviors demonstrated in the exhibit area when the interpreter was not present and produced a significant F-Ratio of 11.367 ($p < .01$).

NULL HYPOTHESIS: There is no relationship between the presence of an interpreter at a science museum exhibit area and the number of attending behaviors demonstrated at an exhibit area

The descriptive statistics for this case are summarized in Table 5 and the analysis of variance is summarized in Table 6.

Table 5

Summary of Descriptive Statistics
Relating Presence of Interpreter to
Number of Attending Behaviors Demonstrated in
Exhibit Area on a Weekday at
Discovery Place

Number of Attending Behaviors Demonstrated		Number of Subjects: 100		Standard Deviation
With Interpreter	Without Interpreter	With Interpreter	Without Interpreter	
9.46	5.24	50	50	6.951

Table 6

Results of the Analysis of Variance Relating
Presence of Interpreter to Number of
Attending Behaviors on a Weekday at
Discovery Place

Source of Variation	Sum of Squares	df	Mean Square	F-Ratio	Significance of F
Interpreter	489.144	1	489.144	11.367	.001
Residual	4131.235	96	43.034		

On the same question, the results of the statistical analysis of the data collected on a weekday at the Science Museum of Virginia showed a mean of 4.20 for number of attending behaviors demonstrated in the exhibit area when the interpreter was present and a mean of 1.43 for number of attending behaviors demonstrated in the exhibit area when the interpreter was not present and produced a significant F-Ratio of 15.861 ($p < .001$). The descriptive statistics for this case are summarized in Table 7 and the analysis of variance is summarized in Table 8.

Table 7

Summary of Descriptive Statistics
Relating Presence of Interpreter to
Number of Attending Behaviors Demonstrated in
Exhibit Area on a Weekday at
The Science Museum of Virginia

Number of Attending Behaviors Demonstrated		Number of Subjects: 60		Standard Deviation
With Interpreter	Without Interpreter	With Interpreter	Without Interpreter	
4.20	1.43	30	30	6.951

Table 8

Results of the Analysis of Variance Relating Presence of Interpreter to Number of Attending Behaviors on a Weekday at the Science Museum of Virginia

Source of Variation	Sum of Squares	df	Mean Square	F-Ratio	Significance of F
Interpreter	141.196	1	141.196	15.861	.000
Residual	498.504	56	8.902		

The results of the statistical analysis of the data collected for this question on a weekend day at Discovery Place and on a weekend day at the Science Museum of Virginia showed a trend toward visitors demonstrating more attending behaviors in the exhibit area when the interpreter was present.

Even though the findings showed significant differences and trends toward visitors spending more time and demonstrating more attending behaviors when the interpreter was present in the exhibit area, results also showed that the exhibit interpreter was more effective on weekdays than on weekend days. From tape observations some of this difference can be accounted for by the fact that on weekend days visitors tend to move in groups in which one of the members acts as an exhibit interpreter if an exhibit interpreter is not present.

Mixed results in the four testing situations relating age of visitor to time spent and to attending behaviors demonstrated in the exhibit area suggest no general conclusions about the

relationship. However, the trends did suggest that the exhibit area at the Science Museum of Virginia had more attention-holding power for adults than teens and children, and that the exhibit area at Discovery Place had more attention-holding power for teens and children than adults. However, despite this difference between two exhibit areas, the findings show the exhibit interpreter enhanced the holding power of both exhibit areas regardless of age of the visitors in the exhibit area.

Age was not a significant factor in the results of the chi-square test which tested whether the exhibit interpreter's presence affected the age of the visitor attracted to the exhibit area on a weekend day at the Science Museum of Virginia. However, there was a greater increase in the percentage of visitors aged 3 through 19 who entered the exhibit area when the exhibit interpreter was present (57% compared to 33%) than increase in percentage of adults who entered the exhibit area when the exhibit interpreter was present (59% compared to 49%). During the same filming session adults were observed spending more time and demonstrating more attending behaviors in the exhibit area than children and teens.

The question, "Does the presence of an interpreter at a science museum exhibit area affect the number of visitors attracted to an exhibit area?", was tested on a weekend day at the Science Museum of Virginia. The percentage (58%) of the first 50 visitors passing the exhibit area who entered the area while the exhibit interpreter was present was compared with the percentage (46%) of the first 50 visitors passing the exhibit

area who entered the area while the exhibit interpreter was not present. The z-test for proportionality was used to analyze the relationship between the presence of an interpreter in the exhibit area and the proportional number of visitors attracted to the exhibit area. A trend toward a higher percentage of visitors entering the exhibit area when the interpreter was present was observed.

Discussion

The findings of this study warrant the conclusion that the exhibit interpreter was effective in focusing the attention of visitors in the exhibit area during weekday observations at both museums. This was evidenced by the fact that visitors in the exhibit area when the interpreter was present spent significantly more time and demonstrated significantly more attending behaviors. In addition, during weekend observations at both museums, trends indicated that the exhibit interpreter positively influenced the length of time spent and the number of attending behaviors demonstrated in the exhibit area. John Falk concluded from a study conducted in the Hall of Human Biology at the British Museum of Natural History that a combination of length of time spent and visitor attending behaviors were good predictors of learning in a museum setting (Falk, 1983). Thus, the exhibit interpreter's attention-focusing power could increase the learning potential of museums and focus visitors' attention so that they could perceive, encode and store more content of the museum and thus learn from the museum experience, a major goal of science museums.

Other studies point out the exhibit interpreter's positive influence on visitor experiences and learning. In a study conducted in the Mysteries in History Gallery at the Children's Museum in Indianapolis, Barbara Tymitz-Wolf assessed visitor learning relative to key pedagogical principles applied to the museum context, behavioral objectives formulated, and the impact of modifications in format presentation. When the presentation format varied to include an interpreter in the exhibit, the results showed that respondents to a post-exhibit survey stated more frequently the major intent of the exhibit, which was to get across the idea that a person can learn about the past from clues in the present (Tymitz-Wolf 1986b). In addition, of the respondents that visited the Mysteries in History Gallery, when an interpreter was present 56% of the children and teens said the interpreter made the visit a lot more fun; 50% said the interpreter made it more interesting; 86% of the adults interviewed in the study said the interpreter made it more interesting; 93% of the adults said the interpreter's presentation made it more likely to remember information longer. Clearly, in this particular exhibit, the exhibit interpreter was a desirable and effective addition to the exhibit. John Koran summarized from selected research in museums that generally visitors are apprehensive about seeking help and that methods should be developed to encourage such interactions that the visitors desire but are reluctant to seek (Koran and Koran 1987). Exhibit interpreters could facilitate social interactions which foster appropriate attention to exhibits and thus stimulate

learning from exhibits.

Robert Wolf in a study of the interpreter-inhabited Discovery Corners of the National Museum of History and Technology investigated the influence of a museum interpreter's presentation on the feelings of visitors and the amount and kind of learning that occurred (Wolf, Munley, & Tymitz 1979). He reported from interview data that all three Discovery Corners were enjoyable places for the visitors and that visitors felt they had learned something. In addition, he reported that engaging objects most consistently drew people to the corners, and direct efforts by the interpreter to entice visitor participation was the second most common way for visitors to become interested in the Discovery Corners.

Koran, Koran, Foster and Dierking in two studies of the use of modeling to direct attention to museum exhibits, found that exhibit interpreters who purposely modeled learning behaviors in the exhibit area were imitated by visitors. More visitors "touched objects, attended to exhibit characteristics, and utilized learning aids "after they watched the exhibit interpreter, disguised as a casual visitor, demonstrate these behaviors. Thus these studies suggest that modeled learning behaviors can direct visitor attention to exhibits, and thus as noted from other research, increase the potential that "visitors will perceive, encode and store considerably more of the content of museums" (Koran, Koran, Foster, and Dierking 1986).

Previous research has indicated that children and teens have different reactions to experiences in science museums than adults

(Koran, Morrison, Lehman, Koran, & Gandora 1984; Koran, Koran, Foster, & Dierking 1986; Tymitz-Wolf 1986b; Koran, Koran, & Longino 1986). Mixed results in the four testing situations relating age of visitor to time spent and to attending behaviors demonstrated in the exhibit area suggest no general conclusions about the relationship. However, the trends did suggest that the exhibit area at the Science Museum of Virginia had more attention-holding power for adults than teens and children, and that the exhibit area at Discovery Place had more attention-holding power for teens and children than adults. Some of the explanation for this difference in age groups spending more time in the respective exhibit areas could possibly be the content level of the exhibit area. At Discovery Place the exhibit area was designed for preschool and early elementary children. In contrast, the exhibit area at the Science Museum of Virginia mostly contained exhibits which were more age appropriate for upper elementary students and older. However, despite the content level difference of the two exhibit areas, the exhibit interpreter enhanced the holding power of both exhibit areas. Thus, the exhibit interpreter's effectiveness spans visitors of all ages.

Conclusion

The exhibit interpreter offers many of the attributes researchers have identified as successful attention-focusing devices: positive feedback, movement, potential for interaction, sound, guidance, complexity and familiarity. Due to these characteristics and others, the exhibit interpreter has the

potential for being effective in both attracting and holding the attention of visitors of all ages, two capabilities not often found in a single exhibit component. Research findings about attention-focusing characteristics as well as the results of this study support the conclusion that the exhibit interpreter, in the complementary role of interfacing between the exhibits and visitors, is an effective attention-focuser in a science museum. Thus, it is recommended that science museums use exhibit interpreters as an effective strategy for focusing the attention of visitors to exhibits.

The results of this study coupled with the results of earlier studies [John Falk's study in the Hall of Human Biology where he concluded that visitors who spend more time and demonstrate more attending behaviors learn more from the exhibit area (Falk 1983); Barbara Tymitz-Wolf's study in the Mysteries in History Gallery which reported that young visitors stated the exhibit interpreter made the exhibit more fun and more interesting and older visitors believed the interpreter aided in increasing the likelihood that information would be remembered longer (Tymitz-Wolf 1986b); the studies by John Koran, Mary Lou Koran, John Foster, and Lynn Dierking in the Florida State Museum using exhibit interpreters disguised as casual visitors to purposely model learning behaviors to direct visitor attention to museum exhibits (Koran, Koran, Foster, & Dierking 1986).] make it reasonable to conclude that the exhibit interpreter has the potential to positively influence learning from science museum exhibits. However, the nature of the interpreter's influence on

learning in museums needs to be assessed further. Though it is clear from this study that exhibit interpreters can be used as a strategy for focusing the attention of visitors to exhibits, it is recommended that further study be done on what visitors learn from interaction with interpreters. Questions concerning the relative merits of different interpreter techniques need to be asked and answered. The exhibit interpreter can be a powerful tool in focusing visitor attention to exhibits and thus initiating the first step to learning from exhibits. Science educators and museum evaluators need to better understand how exhibit interpreters can take visitors beyond that first step and influence higher levels of learning in museums.

References

Beer, Valorie. "Great Expectations: Do Museums Know What Visitors Are Doing?" Curator, 30, No. 3 (1987), 206-215.

The Commission on Museums for a New Century. Museums for a New Century: A Report of the Commission on Museums for a New Century. Washington, D.C.: American Association of Museums, July 1984.

Falk, John H. "Search for Excellence in Informal Education." Focus on Excellence: Science in Non-School Settings, eds. Robert E. Yager and John E. Penick. Washington, D.C.: National Science Teachers Association, 1985.

Falk, John H. "Time and Behavior as Predictors of Learning." Science Education, 67, No. 2 (1983), 267-276.

Gagne, Robert M. The Conditions of Learning. New York: Holt, Rinehart and Winston, 1977.

Koran, John J., Jr., Mary Lou Koran, John F. Foster, and Lynn D. Dierking. "Using Modeling to Direct Attention." Curator, accepted May (1986), gal. 1-9.

Koran, John J., Jr., Mary Lou Koran, and Sarah J. Longino. "The Relationships of Age, Sex, Attention, and Holding Power with Two Types of Science Exhibits." Curator 19, No. 3 (1986), 227-235.

Koran, John J., Jeffrey R. Lehman, Lynn D. Shafer, and Mary Lou Koran. "The Relative Effects of Pre- and Postattention Directing Devices on Learning from a "Walk-Through" Museum Exhibit." Journal of Research in Science Teaching 20, No. 4 (1983), 341-346.

Koran, John J., Jr., Laura Morrison, Jeffrey R. Lehman, Mary Lou Koran, and Luisa Gandora. "Attention and Curiosity in Museums." Journal of Research in Science Teaching 21, No. 4 (1984), 357-363.

Koran, Mary Lou, and John J. Koran, Jr. "A Theoretical Framework for Exploring Research in Museum Education." A presentation prepared for the National Association for Research in Science Teaching Conference, Washington, D.C., April 1987.

Peart, Bob. "Impact of Exhibit Type on Knowledge Gain, Attitudes, and Behavior." Curator 27, No. 3 (1984), 220-237.

Screven, C.G. "Exhibitions and Information Centers: Some Principles and Approaches." Curator 29, No. 2 (1986), 109-137.

Shettel, Harris H. "Exhibits: Art Form or Educational Medium?" Museum News 52, No. 1 (1973), 32-41.

Their, Herbert D., and Marcia C. Linn. "The Value of Interactive Learning Experiences in a Museum." A grant from the National Science Foundation to the Advancing Education Through Science-Oriented Programs (AESOP), December 1975, 1-14.

Tymitz-Wolf, Barbara. International Congress on Learning in Museums: Evaluation Report. Washington, D.C.: Smithsonian Kellogg Project, 1986.

_____. "Mysteries in History Evaluation." Kellogg Demonstration Project: Final Report, 1986b.

Wolf, Robert L. "A Naturalistic View of Evaluation." Museum News July/August (1980), 39-45.

Wolf, Robert L., Mary Ellen Munley, and Barbara L. Tymitz. "The Pause That Refreshes! A Study of Visitor Reactions to the Discovery Corners in the National Museum of History and Technology Smithsonian Institution." Smithsonian Institution, August 1979.